Water Quality of Gilmore Creek in Winona, MN

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Introduction

Multiple factors can lead to water quality degradation of surface waters. However, in urban areas runoff is often the main contributor (USEPA 2000). This can be exaggerated during winter months, when precipitation is held in the form of snow and then released in large volumes as the snow melts. While it may be difficult to determine precisely the source of the pollution, its effect on water quality can be easily measured (Hatt et. al. 2004). Since many biological species are very sensitive to a variety of stressors from water quality issues (USEPA 2011), it is important to monitor the health of a stream to protect its aquatic life.

Study Area

Gilmore Creek in Winona, MN, has a reach length of 4.99 miles and drains about 10 mi^2 through Boller's Lake, Lake Winona, and into the Mississippi River. It is a small, coldwater trout stream which emerges from springs about 2 miles north of the town of Wilson. Half of the watershed is forested, pasture land makes up a third of the drainage, and 12% of the land is developed (Andrews et. al., 2013). Gilmore Creek flows through Boller's Lake, which may alter the physical and chemical nature of the stream water.

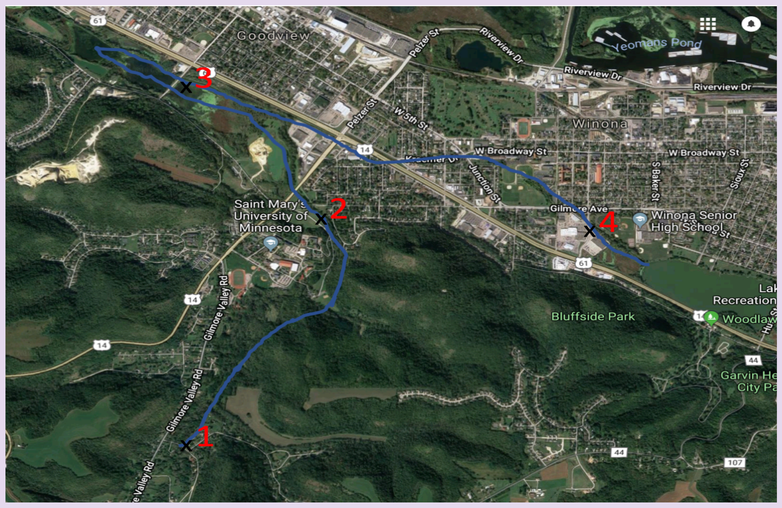

Figure 1. Map of locations for water sampling on Gilmore Creek in Winona, MN, from 16 November 2017 to 13 March 2018. Locations are at Wildwood Drive (1), at Gilmore Avenue (2), immediately after the stream exits Boller's Lake (3) and at Vila Street prior to entering Lake Winona (4).

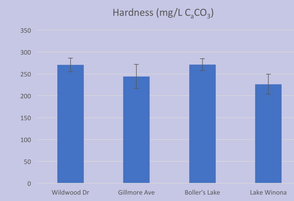

Figure 2. Average dissolved oxygen at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek. Samples were collected 16 November 2017 to 13 March 2018. Indicated a downward shift, except a spike at Boller's lake

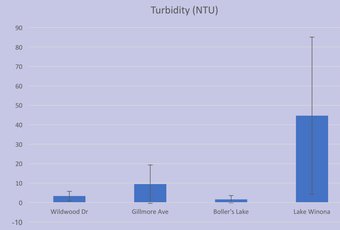

Figure 3. Average turbidity at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek. Samples were collected 16 November 2017 to 13 March 2018 Turbidity increased greatly, as the creek headed downstream

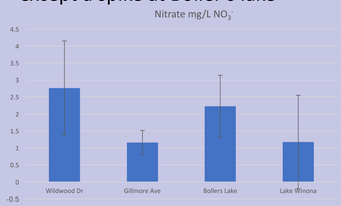

Figure 4. Average Nitrate at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek. Samples were collected 16 November 2017 to 13 March 2018. There is a downward trend with a sip prior to entering Boller's Lake

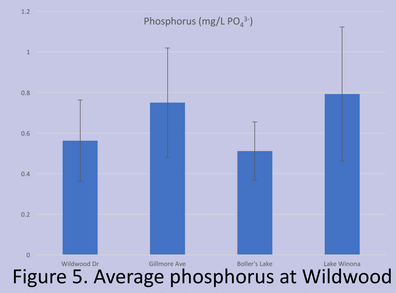

Figure 5. Average phosphorus at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek. Samples were collected 16 November 2017 to 13 March 2018. Phosphorus levels increased, except a dip after Boller's lake

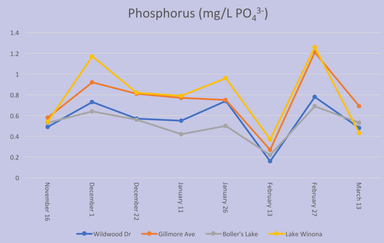

Figure 6. Phosphorus at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek at each of the collection dates. Samples were collected 16 November 2017 to 13 March 2018

	Samples- P value	Dates- P value
Conductivity	0.154881506	0.061889477
Disolved O2	0.451166445	0.136350032
PH	0.237868722	0.367472488
Temperature	8.90219E-07	4.54401E-06
Nitrate	0.020718362	0.599570851
Turbidity	0.00276722	0.2297505
Hardness	0.000222162	0.178112479
Phosphorus	0.000157495	1.01203E-06

Table 1. P-values using anova-two factor without replication software. P values below 0.05 indicate a significant difference.

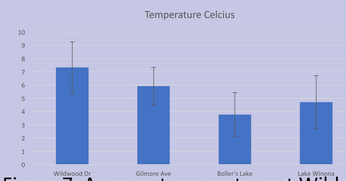

Figure 7. Average temperature at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek. Samples were collected 16 November 2017 to 13 March 2018. Results indicate lowering temperature as the creek goes downstream with a dip at Boller's lake

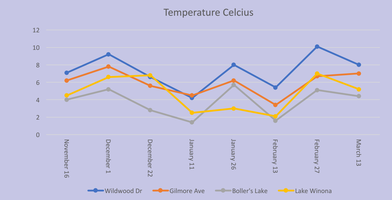

Figure 8. Temperature at Wildwood drive, Gilmore Ave, Boller's Lake and Lake Winona on Gilmore Creek at each of the collection dates. Samples were collected 16 November 2017 to 13 March 2018

Figure 9. Photograph of Gilmore creek at Boller's Lake Location

Conclusion

- Seasonal patterns had an effect on Phosphorus levels and water temperature (Figures 6 and 8)
- Temperature, Nitrate, Turbidity, Hardness and phosphorus varied between sites (Figures 2,3,4,5, and 7)
- Boller's lake had a significant impact on water quality in Gilmore Creek
- Location showed greater variety compared to sampling date

References

Andrews, Erin., Bouchard, Will., Carter, Chandra., Chirhart, Joel., Christopherson, Dave., Duffey, David., Monson, Bruce., O'Hara, Kelly., Nelson, Shawn., Parson, Kris., Schauls, Tiffany., Walerak, Mike. 2013."Mississippi River (Winona) Watershed Monitoring and Assessment Report". Minnesota Pollution Control Agency. Pg 83-85

Hatt, Belinda E., Fletcher, Tim D., Walsh, Christopher J., Taylor, Sally L. 2004 "The Influence of Urban Density and Drainage Infrastructure on the Concentrations and Loads of Pollutants in Small Streams." *Environmental Management*, vol. 34, no. 1

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